The Development of the Malaysian Plastics Industry

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Abstract: Based on our field research, we studied the emergence and development of the plastic injection industry in Malaysia. Our analysis provides evidence to reconsider the mainstream approach to economic growth as found in the literature. Our findings demonstrate that product upgrading from household wares to electrical and electronic parts brought about the growth of the industry. This movement was initiated by innovative entrepreneurs who had been workers at other companies in the same industry. These features are not incorporated in the neoclassical growth models which have mostly been used for empirical studies.

Keywords: Malaysia, industrial development, plastics industry, local industry, field research
JEL classification: L69, 031

1. Introduction

This study has three distinct features: first, our analysis provides evidence to reconsider the mainstream approach to economic growth as found in the literature; second, this is one of the few studies to analyse the development process of the largest local industry in Malaysia, the plastics industry; lastly, our analysis also provides evidence against the bias that the linkages between local industries and foreign direct investments in Malaysia have not been strong.

In the 1980s, economic growth re-emerged as a popular topic in the literature of economics. Empirical studies have mostly dealt with the neoclassical growth models in the tradition of the Solow model (Solow 1956).[1] The approach, however, has two major shortcomings: first, the model uses a single production function for an entire economy or an entire industry. It assumes that the products are homogeneous in an economy or an industry. Second, labour is also assumed to be homogeneous. For example, there is no distinction between entrepreneurs and workers.

This paper examines the emergence and development of the plastic injection industry in Malaysia based on field research missions. It provides evidence to show why the above two shortcomings are crucial. It shows that the growth of the industry was initiated by innovative entrepreneurs who focused on new products, which were plastic parts for electrical equipments. Having observed their success, imitators followed their strategy. This process brought about the growth of the industry. This is the process that Schumpeter defined as 'creative destruction' (Schumpeter 1942). This paper also provides statistical evidence in support of this argument, though the sample size is limited.

We examined the plastic injection industry because in 2001 the plastics industry was

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[1] The study of Mankiw *et al.* (1992) might be one of the most well known in this context.

the second largest employer in Malaysia. It employed six per cent of the total workforce in manufacturing. Since the largest employer is the electrical and electronics industry where most manufacturers are multinational companies, the plastics industry is the largest local employer in Malaysia. Although the plastics industry is important in Malaysia, strangely very few studies have investigated its development process.[2]

Malaysia is noted for attracting foreign direct investments for economic development (World Bank 1993:135). Export processing zones, free trade zone, and licensed manufacturing warehouses have been used as incentives to attract multinational companies. However, there has been some criticisms that linkages with local industries have not been strong in general. This study shows that the growth of the plastics industry could be attributed to the linkage with the multinational electrical and electronics manufacturers.

This introduction is followed by three further sections. Section 2 outlines the development of the Malaysian plastics industry using public data, Section 3 analyses the Malaysian plastics injection industry using data collected by our field research, and the final section highlights the conclusions from our results.

2. The Malaysian Plastics Industry

2.1. Overview of the Development of the Malaysian Plastics Industry

According to a company brochure of a plastics company, Mr. Yong Kam Fook, who founded the Yong Kam Fook plastics company, went on to become the pioneer of the Malaysian plastics industry. Othman and Eng (1986) report some backyard production of plastic goods by small companies in the 1950s.

The first census of the manufacturing industries in Malaysia was conducted in 1959. Since the plastics industry was grouped in the category of 'all other industries,' no specific data on this industry was provided.

The plastics industry was included in the category of 'miscellaneous manufacturing industries' (Industrial code 49) in the next census of 1963, but at that time it was the only industry within that category. According to that census, there were only 27 enterprises in the plastics industry of Malaysia, whose 657 workers accounted for 0.84 per cent of total workforce in manufacturing.

By the third census of 1968, the number of enterprises had risen to 76, and the number of employed workers to 1,949. According to data on the Malaysian electrical industry in the same year (the first year it became available), the electrical industry was somewhat smaller than the plastics industry at that time, comprising a total of 37 enterprises and employing a total of 1,454 workers.

By the fourth census of 1973, the numbers of enterprises and employees in the plastics industry had increased to 299 and 8,702, respectively. The plastics industry grew by more than 30 per cent each year from 1968 to 1973, both in enterprise and employee numbers. The major products of the plastics industry in 1973 were polythene bags and household ware, accounting for 28 and 8 per cent of total industry sales, respectively (Census 1973: 286).

[2] I searched for studies on the Malaysian plastics industry by using the EconLit database. I could not find any studies using the keywords of 'Malaysia' and 'plastic' as of 25 November 2006.

Table 1: Plastics industry and electrical industry in Malaysia

Number of enterprises	1963	1968	1973	1981	1993	2000
Manufacture of plastic products	27	76	299	658	1,111	1,121
Manufacture of electrical machinery	n.a.	37	109	281	787	955
Malaysia total	8,546	9,013	11,060	20,429	23,462	20,455
Number of employees						
Manufacture of plastic products	657	1,949	8,702	17,700	59,942	95,148
Manufacture of electrical machinery	n.a.	1,454	25,317	79,607	338,772	414,126
Malaysia total	77,853	130,257	278,935	556,414	1,266,727	1,574,797

Source: Census of Manufacturing Industries. Various years
Note: Electrical machinery includes electronic apparatus. Since a new industrial code was applied after 2000, the data of electrical machinery cannot be strictly compared between before and after 2000.

The 1973 Census, the first to provide data on the distribution of enterprise sizes, attests to the small scale of enterprises in the industry in the early 1970s. As many as 221 enterprises, 74 per cent of the total in the industry, employed fewer than 20 employees then.

While the electrical industry comprised only 109 enterprises in 1973, considerably fewer than the plastics industry, it employed 25,317 workers, which was far more than that of the plastics industry. Major foreign direct investments in the electrical and electronics industry started around 1970, with large investments by Japanese electrical companies, including Matsushita Electric in 1965 and Hitachi Semiconductor in 1972 (Toyo Keizai Sinposha 2001).

The Malaysian plastics industry grew steadily. In the Census of 2000, the number of enterprises had risen to 1,121, and the number of employees had risen to 95,148, accounting for six per cent of the total workforce in manufacturing. The electrical industry, on the other hand, grew far faster. By 2000 the number of employees had risen to 414,126, accounting for 26 per cent of the total workforce in manufacturing.

2.2. Three Features of the Malaysian Plastics Industry

2.2.1. Locally Owned Industry

In interviews with Malaysian manufacturers, we learned that the Malaysian plastics industry was mostly local-owned in the very early stages of its development and remained so later. Data supporting this argument is also available in the 1973 Census, which reports that 279 of the 299 enterprises in the plastics industry were owned by local people. In addition, local people were responsible for much of the production within the industry. The amount of value added by local people in 1973 was 36 million ringgit, or about 81 per cent of the total production in the industry for that year. Similar data have not been available since 1973, but our interview responses suggest that the rate of local ownership is still very high.

2.2.2. Strong Relationship with the Electrical Industry

As we will see later, the plastics industry has tightened its ties with the electrical and electronic industry. In 1973, the vast majority of products manufactured by the plastics industry were polythene bags and household wares. By 1992, however, 20 per cent of all manufactured plastic products were electrical and electronic parts, according to a report from the Malaysian Industrial Development Authority (MIDA) (MIDA 1993:14). In our interview with the MIDA Tokyo Office in 2001, we learned that electrical and electronic parts now account for about one-third of all parts manufactured in the industry.

2.2.3. Injection Moulding Has the Largest Share of Production Process

The production processes in the plastics industry can be divided into several categories, including injection moulding, extrusion, blow moulding, and so on. Injection moulding is best suited for the rapid production of identical products. Plastic buckets and TV casings are good examples of products produced by injection moulding. The merit of the technique is its reliability in producing precise products, insofar as the moulds themselves remain precise. The demerit is that the moulds are expensive.

Extrusion is the best process for manufacturing pipes. Blow moulding is used to produce pet bottles. Table 2 shows the shares of the foregoing production processes in the Malaysian plastics industry in 2001. Injection moulding had the largest share of all.

Table 2: Shares of production processes in the Malaysian Plastics Industry in 2001 (unit: per cent)

Injection moulding	40
Film extrusion	30
Blow moulding	8
Pipes and profile extrusion	7
Foam moulding	5
Composite fabrication	5
Others	5

Source: Giam (2002)

3. Emergence and Development of the Plastic Injection Industry

3.1. Analysis Based on Field Research

In this section we will analyse the emergence and development of the plastic injection industry in Malaysia based on our field research conducted from July to September 2003.[3] We visited six states on the west of Peninsular Malaysia and the Federal Territory of Kuala Lumpur. Of the 40 plastic injection firms visited, three failed to provide useful information, hence 37 sample firms were used for the final study.

[3] With the help of the Malaysian Plastics Manufacturers Association (MPMA), we made appointments with a list of randomly selected plastic manufacturers who kindly consented to interviews. As the interviews were conducted only with those who could speak English because the firms knew that we were foreigners, there may have been some bias in the survey population.

3.1.1. Classification of Firms

We classified the sample firms into four categories based on the dates or conditions of their establishment: 'Pioneer,' 'Follower,' 'New Pioneer,' and 'Latecomer'. The Pioneers were firms established in the early stage of development of the plastic injection industry, from 1950 to 1970. The Followers were firms that entered the industry in the second stage of its development, from 1971 to 1982. The one firm classified as a New Pioneer started production by specialising in electrical and electronic parts in 1982. The Latecomers were firms established from 1982 to 1997.

Our reason for singling out one firm as a New Pioneer calls for some explanation. Around 1980, multinational electrical companies began approaching the local plastic manufacturers to subcontract the production of plastic parts. Some of the Malaysian firms

Table 3: Characteristics of enterprise classifications

	Pioneers	Followers	New Pioneer	Latecomers
Number of firms	3	8	1	26
Period of enterprise	1950 to 1970	1971 to 1982	1982	1982 to 1997
Place of enterprise (number of firms)	Kuala Lumpur (3)	Kuala Lumpur (2) Johor (3) Selangor(1) Penang (1) Malacca (1)	Kedah (1)	Selangor (12) Johor (5) Perak (3) Kuala Lumpur (2) Penang (2) Malacca (1) Kedah (1)
Schooling of founders (Average years)	6.3	11.0	14.0	13.2
Former occupation of founders				
Plastic manufacturers	0	2	1	11
Traders of plastic goods	0	2	0	1
Other manufacturers	2	2	0	5
Other traders	0	0	0	1
Others (e.g., services)	0	2	0	5
Not available	1	0	0	3
Productions shares (the period of enterprises)				
Electrical and electronic parts	0.00	3.75	100.00	66.60
Automotive parts	0.00	7.50	0.00	4.00
Household wares	100.00	45.00	0.00	17.80
High-technologies	0.00	0.00	0.00	7.40
Others	0.00	0.00	0.00	7.40

Source: Author's interview

started to produce plastic parts for electrical appliances, while maintaining the production of plastic household wares. The New Pioneer stood apart from the others by taking the brave step of specialising exclusively in electrical parts.[4] According to our interview responses, the orders for electrical parts were massive, but fluctuated too sharply for most firms to commit to exclusive production. The New Pioneer's decision to specialise was considerably risky and marked a milestone for the industry.

Subsequently, a good number of manufacturers followed suit and began specialising in electrical parts themselves. We therefore classified firms before the New Pioneer as Followers and after him as Latecomers. Table 3 summarises the features of the four groups. Several interesting trends could be seen.

1. First, the locations of the enterprises spread out from Kuala Lumpur to other regions as time passed. Geographically, the new industry started within an economic centre and then diffused to other regions.
2. Second, most of the founders in the four groups had approximately the same length of schooling, with the exception of the Pioneers. This was contrary to our expectation, namely, that the founders would require more education as time passed. This may also indicate that education is unassociated with the birth of new companies.
3. Third, about 40 per cent of the founders in the Latecomers group gained experience in plastics manufacturing before starting their businesses.
4. Fourth, 66.6 per cent of the products produced in the industry were electrical and electronic parts by the time the Latecomers started their businesses.

The third and fourth features indicate that most founders in the Latecomers group were spin-outs from existing plastics manufacturing firms who concentrated in plastic parts for the electrical and electronics industry in their new businesses.

3.1.2. Emergence of the Plastic Injection Industry

The factors that provide the impetus for people to start new businesses and the methods used to acquire new technologies are quite important topics from the academic and practical points of view. This information enriches our knowledge of economic development in the field of economics and helps governments plot development plans for new industries. Table 4 summarises the motives for founding enterprises and the methods used to acquire technology.

1. Firm A is Yong Kam Fook, a manufacturer discussed briefly above. No information could be obtained on the founder's motives for establishing the firm since the founder Mr. Yong had already passed away. The company brochure tells us that Yong invented the injection machine used in the company.
2. Firm B was in the food processing business before it starting making plastic parts. The founder of firm B realised the high profitability of the plastic business on a trip to Taiwan and Hong Kong. He imported injection machines and engineers from Taiwan to produce plastic goods.
3. The founders of firm C grew and sold pet fish before they entered the plastic business.

[4] The New Pioneer is a special company only within our sample. We do not deny that there could be other new pioneer firms around 1980.

Small plastic aquariums for selling pet fish were very expensive at that time in Malaysia, as they had to be imported from foreign countries. The founders realised that they could sell their pet fish at lower prices and in higher volume if they stored them in small plastic aquariums produced in-house. They imported injection machines from Japan and asked the machine maker to teach them how to produce plastic goods.

Table 4: Motives for establishing enterprises and methods for acquiring technology

	Motives of enterprises	Acquisition of technology
Firm A	n.a.	Invention of injection machines
Firm B	Travel to Taiwan and Hong Kong and realise the profitability of plastic goods	Import machines and engineers from Taiwan
Firm C	Need to produce plastic aquarium	Import machines from Japan and ask machine makers to teach technology

Source: Author's interview

These three firms could be called Pioneers, as none of them started their plastic businesses due to the influences of other local plastic manufacturers. Firms B and C were founded for different reasons. Firm C's motive was derived from its original business, whereas firm B's was unrelated to its original business. However, both B and C imported their technologies from advanced countries, which set them apart from firm A. This is the latecomers' advantage described by Gerschenkron (1962), whereby less developed countries can import their technologies from more developed countries in order to develop their industries. The Malaysian plastic injection industry utilised this latecomers' advantage to emerge and develop.

3.1.3. Development of the Plastic Injection Industry in Malaysia

Table 3 shows that two of the eight founders in the Followers group had experience in plastics manufacturing, while another two had experience in trading plastic goods before starting their businesses. The other four founders entered the plastic business from unrelated businesses, but two of them hired workers from other plastic manufacturing companies to start out. This suggests that from 1972 to 1982, the second stage of development in the plastic injection industry, head-hunting for skilled workers and spin-outs from existing companies were common. Judging from the figures in the 1973 Census, the number of enterprises increased substantially during this decade. The second stage of development appears to have been characterised by the spillover of technology and information through the transference of people.

The third stage of development started with the appearance of the New Pioneer. The founder was working at local plastic firms that produced household wares and electrical parts. He started his own company with a couple of people in 1982, and by 2001, hired 14,000 workers.

Specialisation in electrical and electronic parts has one merit and two demerits. The merit is the massive volumes of the orders. The demerits are the sharp fluctuation in the volume of orders and the high standards of quality demanded by the electrical companies placing the orders. Most local firms realised the merit and demerits of subcontracting for

foreign electrical firms and hedged the risk by continuing production of household wares. The New Pioneer, however, took the risk and grew fast.

After the New Pioneer was founded, the link between the plastics industry and electrical industry strengthened considerably. By the time the Latecomer firms started entering the industry, the production share of electrical and electronic parts was 66.6 per cent on average. Moreover, 11 out of the 26 Latecomers interviewed had specialised exclusively in electrical and electronic parts from the very beginning of their operations. Thus, it appears that many manufacturers concluded that the merit of specialisation outweighed its demerits.

The development of the Malaysian plastic injection industry can be divided into three stages: the emergence of the industry, development based on the production of household goods, and development based on the production of electrical and electronic parts.

3.1.4. Performance of the Four Groups

Table 5 shows the performance of the four groups in 1995 and 2001. We perceived sales amount and number of employees to be the index of a firm's performance. The data were obtained by our interviews and we can make three observations:

- First, the New Pioneer was the best performer.
- Second, the Pioneer performed better than the Followers and Latecomers, suggesting that experience in the market matters.
- Third, the variance of performance among firms in the Follower and Latecomer groups was relatively high. This point will be investigated more closely in the next subsection.

Table 5: Performance of enterprise groups

	Pioneers		Followers		New Pioneer		Latecomers	
	1995	2001	1995	2001	1995	2001	1995	2001
Sales (million Ringgit)								
Average	50.5	67.5	14.3	18.7	50.0	100.0	10.0	20.8
Coefficient of Variation	10.9	33.3	78.8	69.5	0.0	0.0	106.7	123.7
Number of employees								
Average	402.0	446.7	253.1	331.0	800.0	1400.0	133.1	225.0
Coefficient of Variation	4.7	11.2	95.5	108.9	0.0	0.0	137.3	119.8

Source: Author's interview
Note: As for Pioneers, sales figures for 1995 and 2001 were not provided by a firm. As for Latecomers, sales figures were not provided by six firms for 1995 and by two firms for 2001.

3.1.5. Features of Large and Small Enterprises in Followers and Latecomers

We divided the firms in the Follower and Latecomer groups into two sub-groups; large enterprises and small enterprises. The Malaysian government has its own definition of small- and medium-sized firms, which are firms employing less than 150 employees. We adhered

Table 6: Features of large and small enterprises in the Follower and Latecomer groups

	Followers		Latecomers	
	Large	Small	Large	Small
Number of enterprises	4	4	11	15
Year of enterprise				
Average	1976.8	1978.3	1991.7	1992.1
Standard deviation	4.2	4.2	1.6	3.8
Sales (million Ringgit)				
Average (2001)	30.6	6.85	39.3	7.6
Coefficients of variation (2001)	21.8	50.5	79.5	57.1
Annual growth rates (1995-2001)	30.3	-2.9	169.7	94.78
Number of employees				
Average (2001)	580	83	431	75
Coefficients of variation (2001)	63.2	46.3	72.4	41.4
Annual growth rates (1995-2001)	32.6	20.0	87.5	45.7
Schooling of founders				
Average years	12	10	13	13
Numbers of holders of a CMM*	2	0	8	5
Average production shares (2001)				
Electrical and electronic parts	57.5	17.5	68.7	66.4
Automotive parts	1.3	29.0	12.2	7.4
Households	28.8	47.5	5.9	18.2
High technologies	0.0	0.0	4.5	4.3
Others	12.5	1.0	8.7	3.7

Source: Author's interview

* Coordinate measuring machines (CMMs) are inspection machines for products.

Note: As for Pioneers, sales figures for 1995 and 2001 were not provided by a firm. As for Latecomers, sales figures were not provided by six firms for 1995 and by two firms for 2001.

to this definition. Table 6 describes the features of the large and small enterprise subgroups in the Follower and Latecomer categories. Table 6 presents three interesting points about the performance of plastics companies in Malaysia:

1. First, large enterprises seemed to take up a large share of the production of electrical and electronic parts in both groups in 2001. This suggests that the plastics companies that produced electrical and electronic parts might have grown faster than the others.
2. Second, most large enterprises in both groups had inspection machines known as coordinate measuring machines (CMMs). CMMs are expensive, but manufacturers need them to produce complex and precise pieces. This suggests that the capability of producing complex and precise products is now important for plastics manufacturers in Malaysia.
3. Third, the founders of large and small companies received about the same years of schooling, suggesting that education of the founders might not have had a great effect on the performance of the plastics companies.

Based on the above, several elements seemed to have affected the growth of plastic injection companies in Malaysia; the length of operation, the production share of electrical

and electronic parts, and the technical capability to produce complex, precise products. We, however, need to examine these elements statistically, even though the sample size is limited.

3.2. Statistical Analysis

3.2.1. Elements Affecting Performance of Plastics Companies

Here, we used data collected from our field research to statistically examine elements that may have affected the performance of plastic injection companies in Malaysia. Given the limited size of our survey population, we used ordinary least square regressions for our statistical analysis.

The following hypotheses were tested:

Hypothesis 1: Older companies have performed better than the others.

Hypothesis 2: Companies that produce a higher proportion of electrical and electronic parts have performed better than the others.

Hypothesis 3: Companies with the technical capability to produce complex and precise products have performed better than the others.

Hypothesis 4: The education of the current managing director have not affected the performance of the companies.

Hypothesis 5: The agglomeration of industry has affected the performance of the companies.

Hypothesis 6: The distance to customers has affected the performance of the companies.

Hypotheses one to four were derived from the discussion above. Hypothesis five is derived from the argument in recent literature in economics that the agglomeration of industries positively affects company performance. We propose hypothesis six intuitively, suspecting that the delivery time to customers might have an important effect on company performance.

We adopted the number of employees as a proxy variable representing company performance. Sales levels would have been a more reliable indicator, but the sample companies were only willing to share information on their workforce. As most of the companies were not publicly listed, they were reluctant to disclose their sales figures. Thus, the respondent and explanatory variables in our regression are as follows:

1. The number of employees in 2001 (variable name: EMP01)
2. The year of establishment (variable name: OPERAT)
3. The production share of electrical and electronic parts within the company in 1995 (variable name: ELESH95)
4. CMM dummy (variable name: CMM)
   Companies that had CMMs in 2001 are coded as one.
5. Years of schooling of the current managing director (variable name: EDUMD)
6. Agglomeration dummy (variable name: SPJ)
   Electrical companies agglomerate in the States of Selangor, Penang, and Johor in Malaysia. We coded 1 for the companies that were located in one of these three states in 1995.
7. Distance to customers (variable name: DISCU)

Based on the average delivery times indicated by the sample companies in the interviews, we defined the explanatory variable as the average number of minutes to the customer in 1995.

8. Pioneer dummy (variable name: PDUM)

This variable is not from our hypothesis above. As the companies in the Pioneers group had established brand names for their products, we used this dummy variable to cancel out the brand name effect on company performance. Here we coded 1 for the companies in the Pioneer group.

Table 7 reports the estimated results for company performance. The first column of the table shows the basic estimation, and the second and third columns show estimations with insignificant variables excluded. According to the analysis, the number of years in business, the production share of electrical and electronic parts, and CMM ownership were significant. The length of education of the current managing director was not significant. This provided statistical support for hypotheses one to four.

On the other hand, agglomeration, distance to customers, and brand name (dummy variable assigned to the Pioneers) did not statistically affect company performance.

Table 7: Determinants of company performance

Equation	1	2	3
Dependent variable	EMP01	EMP01	EMP01
Regression	OLS	OLS	OLS
Adjusted R-squared	0.37	0.4	0.41
Sample size	28	28	28
Constant	40803.10*	41975.00*	43164.80*
	(1.96)	(2.51)	(2.64)
OPERAT	-20.70*	-21.29*	-21.90*
	(-1.96)	(-2.50)	(-2.64)
ELESH95	3.44*	3.45*	3.38*
	(1.96)	(2.01)	(2.01)
CMM	389.97**	392.79**	410.39**
	(2.96)	(3.12)	(3.42)
EDUMD	28.59	28.42	27.82
	(1.37)	(1.40)	(1.39)
SPJ	-180.61	-176.9	-154.54
	(-1.37)	(-1.43)	(-1.34)
DISCU95	-0.47	-0.46	
	(-0.56)	(-0.57)	
PDUM	28.99		
	(0.10)		

Note: *t*-ratios are reported in parentheses, where * and ** denote significance at the 5 per cent and 1 per cent levels, respectively.

3.2.2. Determinants of Production Share of Electrical and Electronic Parts

According to the regression analysis above, the production share of electrical and electronic parts positively affected company performance. This brought us to a further question, namely: What determined the production share of electrical and electronic parts in each company? We propose the following hypothesis based on our interviews.

Hypothesis 7: Managing directors with longer experience working at other plastics companies will produce a higher proportion of electrical and electronic parts in their companies.

According to our interviews, successful companies that produced more electrical and electronic parts tended to have managing directors with long years of experience working at other plastics companies. We also used ordinary least square regressions to examine the elements affecting the production share, for the same reason explained above. The respondent variable was the production share of electrical and electronic parts within the company in 1995 (variable name: ELESH95). Explanatory variables were the managing directors' years of work experience at other plastics companies (variable name: PPEM) and the same variables used before. The estimation results are shown in Table 8.

Table 8: Determinants of production share of electrical and electronic parts within companies

Equation	4	5	6
Dependent variable	ELESH95	ELESH95	ELESH95
Regression	OLS	OLS	OLS
Adjusted R-squared	0.11	0.18	0.18
Sample size	28	28	32
Constant	-3077.99	-2711.73	-1742.13
	(-1.25)	(-1.36)	(-1.06)
PPEM	1.61	1.64*	1.97*
	□1.63□	□1.73□	□2.28□
OPERAT	1.59	1.4	0.91
	(1.27)	(1.38)	(1.09)
SPJ	-12.22	-11.04	-10.27
	(-0.77)	(-0.81)	(-0.82)
EDUMD	-0.98	-1.04	
	(-0.39)	(-0.43)	
DISCU95	0.00003		
	(0.0003)		
PDUM	9.63		
	(0.28)		

Note: *t*-ratios are reported in parentheses, where * and ** denote significance at the 5 per cent and 1 per cent levels, respectively.

The fifth and sixth columns show that PPEM was significant, providing statistical support for hypothesis seven by regression analysis.

Table 9: Determinants of CMM ownership

Equation	7	8	9
Dependent variable	CMM	CMM	CMM
Regression	Probit	Probit	Probit
R-squared	0.22	0.22	0.21
Sample size	30	30	30
Constant	-155.56	-157.58	-167.04
	(-1.70)	(-1.73)	(-2.01)
OPERAT	0.08	0.08*	0.08*
	(1.69)	(1.72)	(2.00)
EDUMD	0.06	0.06	0.05
	(0.64)	(0.62)	(0.59)
DISCU95	-0.0007	-0.0007	-0.0007
	(-1.28)	(-1.38)	(-1.38)
PDUM	1.33	1.39	1.43
	(1.01)	(1.10)	(1.15)
PPEM	0.0008	0.0009	
	(0.22)	(0.24)	
SPJ	0.09		

Note: *t*-ratios are reported in parentheses, where * and ** denote significance at the 5 per cent and 1 per cent levels, respectively.

3.2.3. Determinants of CMM

As the ownership of a CMM positively affected the company performance, we next asked: What elements compel companies to acquire CMMs? We expressed the hypothesis to be tested was expressed follows:

Hypothesis 8: New companies tend to have CMMs.

This hypothesis is derived from Table 6. As many as eight of the small companies in the Latecomers group owned CMMs, suggesting that the newer companies tended to acquire them. Here we applied a probit estimation. CMM is taken as the respondent variable, and the explanatory variables are the same as before. Table 9 shows the estimated results.

According to the estimated results, OPERAT is positively significant, providing statistical support for Hypothesis 8.

The following observations were derived from our regression analysis:

1. First, the older plastic injection companies that produced more electrical and electronic parts using CMMs for inspection performed better than the others.
2. Second, plastic companies run by managing directors with longer experience at other plastic companies produced higher ratios of electrical and electronic parts.
3. Third, young companies tended to own CMMs.

4. Conclusion

We studied the emergence and development of the plastic injection industry in Malaysia based on our field research. The first firms in the industry were producers of plastic household wares. In the second stage of development, manufacturers produced both household wares and electrical and electronic parts. The third stage of development commenced with the appearance of manufacturers specialising in electrical and electronic parts.

We statistically examined determinants of the performance of plastics companies using the data we collected. Production share of electrical and electronic parts and CMM ownership positively affected their performance. This confirmed that focusing on a new product, namely electrical and electronic parts, promoted the growth of the industry. Our statistical analysis also showed that the entrepreneurs who had longer experience at other plastic companies produced higher ratios of electrical and electronic parts.

Our findings demonstrate that product upgrading brought about the growth of the industry. This movement was initiated by the innovative entrepreneurs who had been workers at other companies in the same industry. These features are not incorporated in the neoclassical growth models which have mostly been used for empirical studies. They assume homogenous products and homogenous labour. They also assume that technical progress occurs exogenously. These assumptions are flaws and may not contribute much to understanding development mechanisms of an industry and an economy.

The estimates from our analysis also indicate that the years of schooling of the managing directors did not affect their performance. This is an interesting point, as human capital is a hot issue in the empirical studies on economic growth (example, Mankiw *et al.* 1992). We formed the following interpretation: basic education of around ten years seemed a necessary condition to manage the current plastic injection companies in Malaysia. More than a few managing directors with only ten years of schooling ran companies with more than 500 employees. Working experience seemed to be more important than schooling in managing companies.

The Malaysian plastics industry is now experiencing anxiety for its future. Major multinational electrical and electronic companies are shifting their production from Malaysia to China. However, local plastics manufacturers are beginning to respond. Some have started semi-assembly operations or obtained contracts for work as original equipment manufacturers (OEMs) or electronic manufacturing services (EMSs). Since the linkage between the plastics industry and the electrical and electronics industry is strong, the local plastics manufacturers will be able to keep the linkage as long as they can respond to the demand by enhancing their technology, improving management, and increasing productivity. Our statistical evidence that younger companies tended to own CMM suggests that they are moving in the right direction.

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